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Dedicated to the Conservation of Virginia's Wildlife and Related Natural Resources
Volume 44, Number 7 *July 1983*

Special Issue

In this issue, we highlight the legendary Chesapeake Bay.

The world's largest estuary has been under close watch in recent years as the Environmental Protection Agency's Chesapeake Bay Program conducted an intensive study of the Bay's environmental quality and management of its resources. EPA recently completed this study and has published the first in a series of reports on its findings.

An upcoming conference of governors and other key officials of Virginia, Maryland and Pennsylvania will focus more attention on the Bay, its problems and potential solutions.

An essential element in these efforts to solve problems faced by the Chesapeake Bay is public participation. We encourage you to learn all you can about this precious resource—beginning with this issue of Virginia Wildlife*—and to do whatever you can to insure that its future is as glorious as its past.*

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"Chesapeake Oyster Tongers," by John M. Barber, Richmond. From the collection of C.H. Guynn, Springfield.

Back cover: It's time to order the 1983-84 Sportsman's Calendar. Calendar cover painting by Joe Seme of Boone, North Carolina.

Protecting A Resource

A Guest Editorial

Charles S. Robb

Governor

The Chesapeake Bay is a unique national resource and we in Virginia are fortunate to have access to its many offerings. From its earliest discovery, man has been impressed with the Chesapeake Bay's size, navigability, and abundance of food. The Algonquin Indians named it "Chesepiooc" which loosely translates as the "Great Shellfish Bay." The early Spanish explorers considered it "the best and largest port in the world." Even after years of intensive use, the Bay still provides millions of pounds of seafood, is a major hub for shipping and commerce, supplies a huge natural habitat for wildlife and offers a wide variety of recreational opportunities for residents and visitors. However, this continually expanding use over the years has resulted in serious problems in the Bay.

This year the Chesapeake Bay Program, established by the Environmental Protection Agency in accordance with a 1976 Congressional mandate, concludes a six-year study of the Bay's water quality and resources. The results of the study have confirmed that the Bay system is undergoing major ecological changes including a decline in submerged grasses, an increasing loss of dissolved oxygen in bottom waters and increasing amounts of toxic substances in certain segments of the Bay.

The conclusion of the Chesapeake Bay Program makes available to Virginia a wealth of research data which will better enable us to anticipate future Bay problems and develop long-range management strategies. Management of Bay resources will require not only a continued investment of state government resources, but the support of all Virginians, as well.

We are now in the process of developing a Virginia Chesapeake Bay Management Program which will guide responsible state agencies in the comprehensive, long-range management of Bay resources. The primary goals of the state's program are to protect and enhance the Chesapeake Bay's water quality and resources; to accommodate growth and development in an environmentally sound manner; and to cooperate with other states and the federal government in the management of the Chesapeake Bay and its resources.

The program's success depends not only on sound management by state agencies, but also on the active support of all Virginians. We need to reach as many Virginians as possible with the message that the Bay has serious but not irreversible problems—if we act now to influence positive changes.

Although the Chesapeake Bay is 10,000 years old, in geological terms it is very young. If the entire geological calendar from the earliest fossil formations were equated with one year, the Chesapeake Bay would be less than a minute old. If in one minute of the earth's life the Chesapeake Bay has given to Virginia and the nation as much as it has, imagine what great future potential the Bay has if only we begin to act together to protect its resources.

Virginia Institute of Marine Science

The Chesapeake Blue Crab

This delicious crustacean supports a large commercial fishery.

by Michael J. Oesterling

A blue crab fisherman may fish from 75 to 300 pots, beginning before sunrise and finishing about noon.

Callinectes sapidus—savory, beautiful swimmer. Anyone who has seen an Atlantic blue crab sculling lazily along the water's surface and tasted the sweet white meat contained within has to agree that the crustacean was aptly named. Chesapeake Bay seafood lovers annually consume thousands of pounds of steamed, deviled and caked blue crabs.

Because of the relative ease of capture and delicacy of the meat, the blue crab supports a large commercial and recreational fishery along the entire Eastern Seaboard and Gulf of Mexico. Although the complete range of the blue crab extends from Nova Scotia south to northern Argentina, the Chesapeake Bay is considered to be the center of abundance, annually producing almost 50 percent of the total U.S. harvest. Preliminary landings data indicate that Virginia landed 42,332,928 pounds of hard crabs valued at $8,645,843, and 744,859 pounds of soft shell crabs worth $796,026 in 1982.

Every summer weekend, tidal creeks and bays throughout Virginia are visited by sportsmen intent on catching a crab dinner. Landings of blue crabs by these recreational interests can only be estimated but are thought to be substantial.

To most people, the blue crab is just a delicious seafood. But what exactly is this fine creature? Where does it live? What is its life like? And how is it commercially exploited? These are the questions we will explore.

Life History

Typically, the blue crab is characterized as a coastal inhabitant ranging from the shoreline to a depth of approximately

300 feet. However, it can primarily be found in coves and bays in brackish water of estuaries like those ringing Chesapeake Bay. It tolerates a wide range of salinities, occurring in freshwater to super-salty lagoons throughout its range.

Considered a scavenger by most, the blue crab normally eats a variety of materials, including fish, bottom invertebrates (clams, worms and other crabs) and plant matter. However, it is more characteristically an omnivore that prefers fresh flesh.

The normal life span for a blue crab is only two to three years, although some males may live a few years longer. The blue crab's life cycle begins with the mating of a sexually mature male and female. The sex of a blue crab can be determined by looking at the abdomen shape on the underside of the crab.

In the male, the abdomen is long and narrow, resembling an inverted "T." This shape persists throughout the male's life. In the female, however, there are two different abdomen shapes, depending upon maturity. A juvenile female has a grayish-white triangular abdomen. Adult females have a broadly rounded, or semi-circular, blue-green abdomen.

Female blue crabs obtain adult status at the same time they reach sexual maturity. This transition, when shedding from juvenile to adult, is the only time in her lifetime the female crab is able to mate. Unlike the female, the male reaches sexual maturity before it is fully grown. A male may mate with more than one female, and may mate at any time during its last three growth stages.

Mating takes place during the summer in Chesapeake Bay, beginning in early May and continuing through October, with a peak in late August and early September. Prior to the female's molt from juvenile to adult, she will move to lower salinity waters, pair with a male and, as a "peeler," be carried beneath the male. At this time the crabs are termed "doublers" or "buck-and-rider." While in this cradling position, the female completes her final molt into an adult. Copulation takes place while the female is in the soft intermolt stage.

Following copulation, the male will again cradle the female beneath him until her new shell hardens. Cradling of the female serves a two-fold purpose. Since she mates but once in her life, the cradling assures a male will be present when she is able to copulate. In the soft stage, the crab is extremely vulnerable to predators, so cradling also affords her protection until her new shell hardens. Once the female's shell has hardened, the male will release her.

Spawning (laying of eggs) usually takes place in higher salinity waters at the mouth of the Bay and offshore one to nine months after mating, usually in the spring and summer. A mating later in the year may cause the female to overwinter prior to spawning.

As the fertilized eggs pass out of the body during spawning, they are attached to small hair-like appendages on the underside of the female's abdomen. The entire egg mass, resembling a sponge, may contain 700,000 to 2,000,000 eggs. Disease, predation and unfavorable environmental conditions, however, permit only about one ten-thousandth of one percent (0.000001), or one to two, of the eggs to survive to maturity.

The eggs begin hatching in a week or two, and the young progress through eight larval stages over a seven- to nine-week period until they reach the true crab form. The young crabs spend the majority of their growing life within the nursery grounds of estuaries such as the Chesapeake Bay. Currently, research is underway at the Virginia Institute of Marine Science and Old Dominion University to better describe the recruitment of crabs into the Chesapeake Bay.

Following the first crab stage, growth is rapid. The adult crab stage can be reached 12 to 18 months after egg hatching. After reaching the adult stage, blue crabs live about one more year.

Commercial Fishery

When talking about the commercial blue crab fishery of Virginia, a distinction must be made between hard-shelled and soft-shelled crabs. Although the same animal is involved, the procedures or techniques employed in each fishery differ. In the hard crab fishery, crab pots are the main capturing device in Virginia in summer. In winter, dredges are used to take hibernating crabs from the bottom mud at the mouth of the Bay.

Before 1940, most of the Virginia summer hard crab catch came from trotlines, which are baited, hookless lines anchored on the bottom and usually set parallel to shore. Since the development of the crab pot, trotlines have been used less and less in Virginia.

The other blue crab fishery, centering around soft-shelled crabs, began during the 1870's in Crisfield, Maryland. The hard shells of blue crabs do not allow for the continual size increases associated with growth of fish and other animals. In order for the crab to grow, this hard outer shell must be shed; a soft, pliable crab emerges, expands its soft new shell and "grows into" its new body. At this time, when the crab emerges from the old shell, it is known as a soft-shell crab or more simply a "soft crab."

In the early days of the fishery, methods were used that were designed to catch the soft crab after it had already shed. Today, however, almost all commercial production comes from shedding operations, in which hard crabs are held in either floating pens or in tables on shore until they shed their hard shells.

Water temperatures over 70 degrees are best for active shedding of crabs. In Virginia, soft-shelled crabs are produced from the late spring to early fall, with May through August the most productive months.

Economic trends in the blue crab industry are characterized by fluctuating consumer demand for crab meat, higher product prices, recent innovations in the processing sector, variable seasonal and annual supply, and increased competition from other crab products. These factors have proven to be interrelated. As the overall economy improves, demand for crab meat increases. However, the opposite is also true; a depressed national economy decreases demand for crab meat. Both labor and fuel costs have traditionally plagued the processor and harvester, driving retail prices upward. Coupled to all this are the problems associated with unstable supplies, as reflected by fluctuating commercial blue crab landings.

Despite all these factors, the blue crab continues to be an important and visible symbol of life around Chesapeake Bay. William Warner, in his book *Beautiful Swimmers*, said, "No body of water in the world has been more intensely fished for crabs than the Chesapeake, nor for a longer period, with such successful results." Let's hope the blue crab will continue to provide Virginians with many more years of enjoyment and fine eating.

The Sea Grant Marine Advisory Service at the Virginia Institute of Marine Science has available free brochures on both the hard-shelled and soft-shelled blue crab. Requests for more information should be addressed to: Publications, Marine Advisory Service, Virginia Institute of Marine Science, Gloucester Point, Virginia 23062. □

Fruits of the SEA

by George Flick

illustrations by Jack Williams

The Chesapeake Bay is the largest estuary in the world and provides Virginia, as well as the nation, with an abundant supply of fish and shellfish. Blue crabs are one of the Bay's most popular shellfish and approximately half of the nation's blue crabs are produced in the Chesapeake states.

Blue crab meat is available in several market forms, lump, (backfin), flake, claw and cocktail claw. Lump and flake meat are used for salads, casseroles and stuffings. When appearance is not important, as with deviled crabs, claw meat can be used. These different grades are priced accordingly. Fresh crab meat is generally the least expensive, but you must use it soon after purchase and must be careful to store it properly, preferably on ice. Pasteurized crab meat can also be purchased in hermetically sealed cans and can be kept for several months if stored between 32 and 38 degrees.

In summer, the blue crab molts and the new shell remains soft for several hours unless removed from the water. Soft crabs are a delicacy and can be enjoyed in a variety of dishes, although battering and frying is the most common. Finally, boiled crabs with appropriate seasonings are an excellent way of entertaining family or friends at summer cook-outs.

Almost half of the nation's oysters are produced in the Chesapeake. Oysters are sold by the following size designa-

Recipes

The Chesapeake provides abundant fish and shellfish; here's how to prepare them.

Crabmeat Newburg

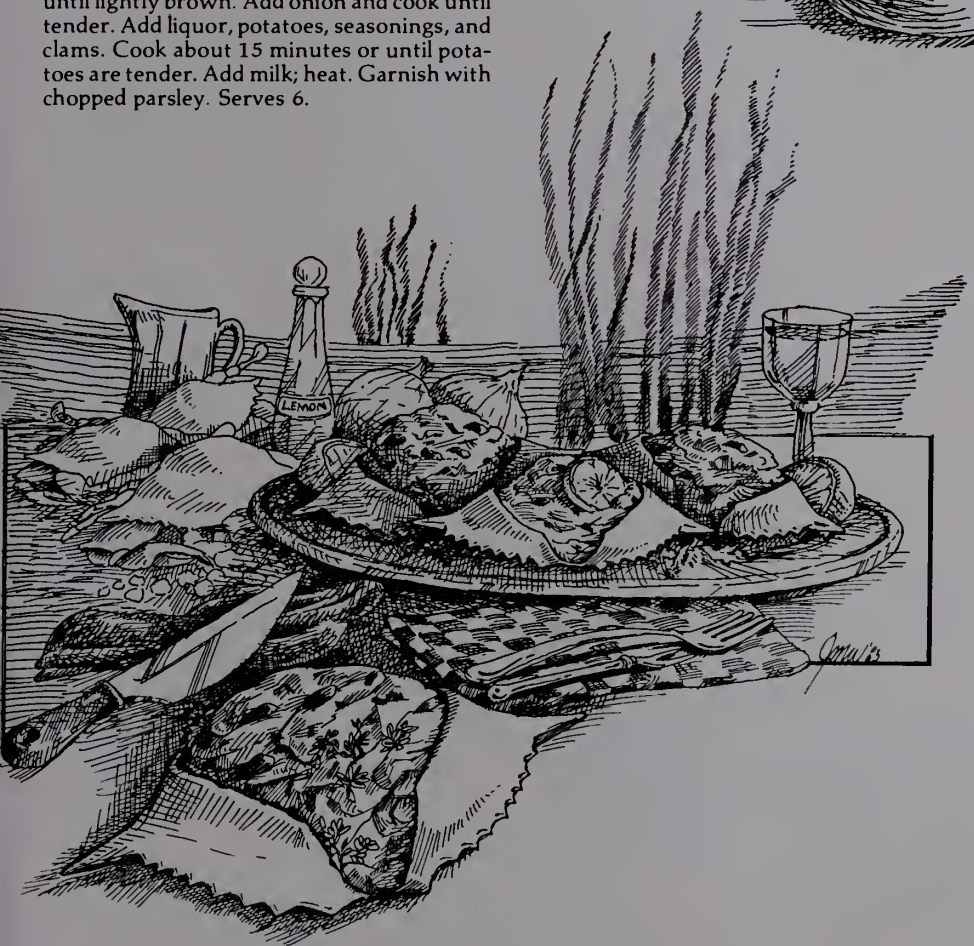
6 tbsp. vegetable oil
3 tbsp. flour
2 cups crabmeat (fresh or canned)
1/8 tsp. nutmeg
Dash paprika
1 tsp. salt
3 tbsp. fresh lemon juice
2 egg yolks
2 cups light cream
Toast points
Sherry to taste

Heat oil in sauce pan over low heat; stir in the flour and seasoning. After flour has mixed well with the oil, gradually add the cream (which has been slightly heated), stir constantly until thickened. Beat egg yolks and lemon juice together slightly. Add egg mixture to cream sauce, stirring constantly until egg yolks are cooked. Put crab meat in bottom of casserole and pour sherry over this and top with the sauce. Brown under broiler. Remove from broiler and garnish with parsley, toast points and lemon wedges. Serves 6.

New England Clam Chowder

1 pint clams
¼ cup chopped bacon
¼ cup chopped onion
1 cup clam liquor and water
1 cup diced potatoes
½ tsp. salt
Dash pepper
2 cups milk
Parsley

Drain clams and save liquor. Chop. Fry bacon until lightly brown. Add onion and cook until tender. Add liquor, potatoes, seasonings, and clams. Cook about 15 minutes or until potatoes are tender. Add milk; heat. Garnish with chopped parsley. Serves 6.



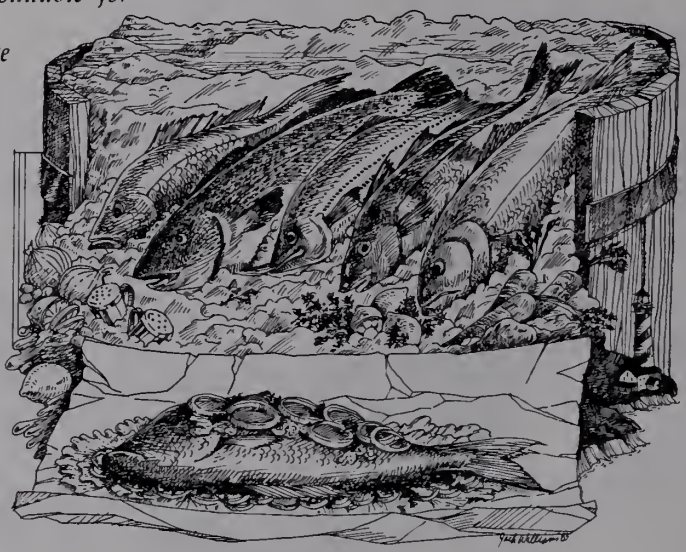
Crab Imperial

1 lb. claw crab meat
1 lb. flounder fillet
3 tbsp. chopped onion
1 tbsp. lemon juice
4 tbsp. butter or other fat
4 tbsp. flour
½ cup bread crumbs
½ cup milk
½ cup flounder broth
¾ tsp. salt
½ tsp. Worchestershire sauce
Dash of tabasco

Boil flounder in 1 pint of water with ¼ tsp. salt only until it will flake. Pour off broth and save ½ cup. Cook onion in butter until tender, and blend in flour. Add ½ cup milk and ½ cup flounder broth and cook until thick, stirring constantly. Flake the cooked flounder fillet, and remove any shell from crab meat. Carefully toss them together with ½ cup bread crumbs. Add seasonings, flounder flakes and crab meat to sauce and carefully mix. Place in greased crab shells, artificial shells or custard cups. Bake at about 350° for 20-25 minutes or until slightly brown. To serve as casserole, you may top with buttered crumbs and bake at 350° for about 30 minutes. Serves 12.

Baked Fish

Any whole fish or fillets suitable for baking
Celery leaves or garden lettuce
Parsley
1 small onion, thinly sliced
Seasoning salt
Salt and pepper to taste
Juice of ½ lemon
1/3 cup butter



Make a bed of parsley, celery leaves or lettuce and thinly sliced onion on a double sheet of aluminum foil. Place fish for baking on sheet and sprinkle with salt, pepper, seasoning salt and lemon juice. Dot with butter. Cover with parsley, celery leaves and onion. Fold foil securely. Bake 30 minutes at 350°.

Baked Stuffed Flounder

½ cup chopped celery
½ cup chopped green onions (tops included)
1 clove garlic, minced
1 stick butter
1 ½ cups moistened bread crumbs
½ lb. boiled shrimp, chopped
½ lb. crabmeat
2 tbsp. chopped parsley
1 egg, slightly beaten
salt, black pepper and cayenne
4 flounder, medium size

Saute celery, onion and garlic in ½ stick butter over low heat. Add bread, shrimp, crabmeat, parsley and egg; mix well. Season with salt, black pepper and cayenne. Split thick side of flounder, lengthwise and crosswise, and loosen meat from bone of fish to form a pocket for stuffing. Brush well with melted butter; add salt and pepper and stuff pocket. Melt remaining ½ stick butter in a shallow baking pan. Place fish in pan; do not overlap. Cover and bake in 375° oven for 25 minutes, or until fish flakes easily with a fork. Remove cover; bake another five minutes. Serves 4.

tions: counts (largest), extra select, select and standard (smallest). Contrary to popular belief, the tasty shellfish can be consumed during all months. Some of the reasons for the theory that oysters could be consumed only from September through April no longer exist. Shucked oysters, as well as oysters on the half-shell, can be used in a variety of tasty dishes. Shucked oysters should be stored on ice while shell oysters are best kept at 40-45 degrees in a moist environment. If kept wet, shell oysters can be held for five to 10 days before consumption. Sometimes shucked and shell oysters, as well as their liquor, will have a red or green color. These pigments are from food consumed by the oyster and present no health hazard to consumers.

One of the East Coast's favorite foods is the hard clam, sometimes called the quahog. This bivalve can be eaten raw or in a variety of dishes. Clams are sold by size; however, their names may vary with geographical region. In the Chesapeake states, the more common names (largest to smallest) are chowders, cherrystones, topnecks and littlenecks. The chowders are tough and can only be used for dishes like Manhattan or New England clam chowder. The other sizes can be eaten at clam bakes, on the half shell, in dishes such as clams casino or over linguini. Clams are usually purchased in the shell and can be kept for a week if stored in a cool (approximately 40 degrees) and moist environment. Although fresh clams, like dying or dead clams, will sometimes have a gaping shell, you can easily distinguish the difference. Simply tap the shell lightly. A live clam will quickly close while an unacceptable clam will close very slowly, if at all.

The Bay is also home to a large variety of fin fish. Some fish occur all year 'round while many, including shad and herring, occur for a brief time period. Some fish, such as bluefish, are popular for sportfishing, while others, such as rockfish and flounder, are highly prized for the dinner table. The Bay's wide variety of fish species during the course of a year can please the most discriminating taste.

While the Bay has a long tradition and reputation for delicious seafood, the future is now questionable. There are a number of competitive uses for the Bay's resources as transportation, recreation and waste disposal. Unfortunately, some of these uses are mutually competitive. Even without man's demand on the Bay, nature itself will eventually change the Bay to where it is no longer productive. Until that day occurs, Virginia, as well as the entire nation, can continue to enjoy one of nature's most bountiful sources of seafood. □

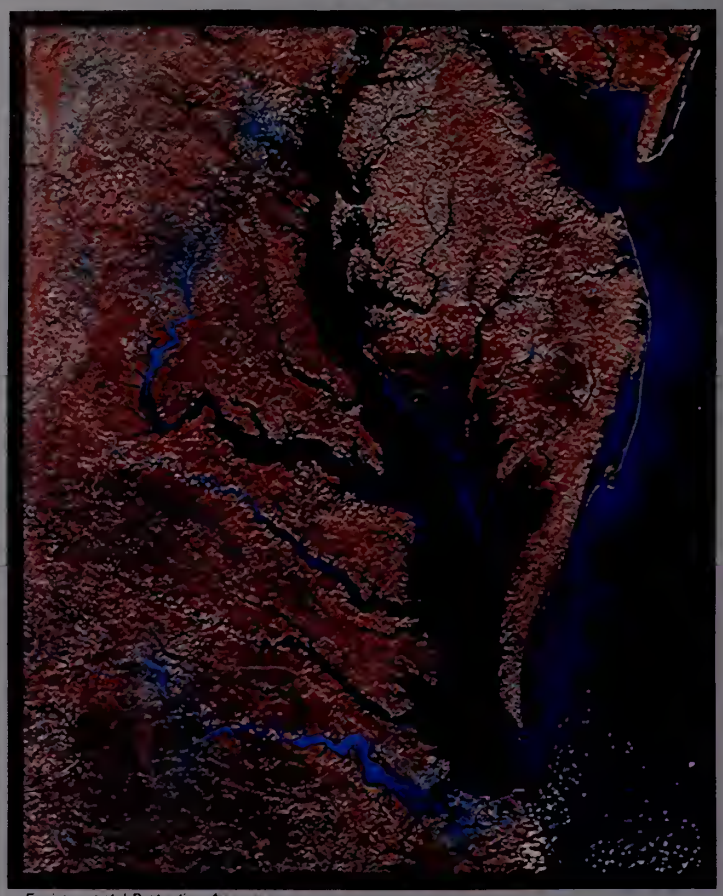
Chesapeake Bay Foundation

The Bountiful CHESAPEAKE: *Too Rich For Its Own Good*

by Fran Flanigan and Bill Portlock

"There is but one entrance by the sea into this country, and that is at the mouth of a very goodly bay, the wideness whereof is near 18 or 20 miles. The cape on the south side is called Cape Henry; the north cape is called Cape Charles. Within is a country with large and pleasant navigable rivers; heaven and earth never agreed better to frame a place for man's habitation."

—Captain John Smith



Environmental Protection Agency

Bill Portlock

Virginia Institute of Marine Scienc

Infrared photography (above) helps scientists identify types of vegetation surrounding the Bay; a group of Forster's terns (above right), congregates on a tidal flat; a fiddler crab scutters along the beach (right).

Largely due to man's habitation, the Chesapeake Bay has changed considerably since 1609 when Captain John Smith first mapped it. Although the Bay continues to be a beautiful, important and highly productive resource, current studies show it is a stressed and vulnerable body of water. Man's many uses of the Bay continue to take a toll on everything living within its boundaries.

The Chesapeake Bay is an interconnected system of tributaries, draining a huge, 64,000-square-mile area. Included in this land area, or watershed, are parts of six states: New York, Pennsylvania, West Virginia, Delaware, Maryland and Virginia. The actual Chesapeake Basin encompasses about 2,200 square miles, but we must also include the more than 250 rivers and creeks that funnel freshwater, sediments and nutrients into the Bay.

The Chesapeake's tributaries provide spawning and nursery sites for several important species of saltwater fish, such as the white perch, striped bass and shad. During the warmer months, several marine species, including bluefish, weakfish, croaker, menhaden and spot, enter the Bay to feed on its rich food supply.

Perhaps one of the Chesapeake's most valuable functions, yet one that is difficult to put a price tag on, is its role as a major wildlife habitat. The Bay and surrounding wetlands provide a home for a myriad of plants and animals.

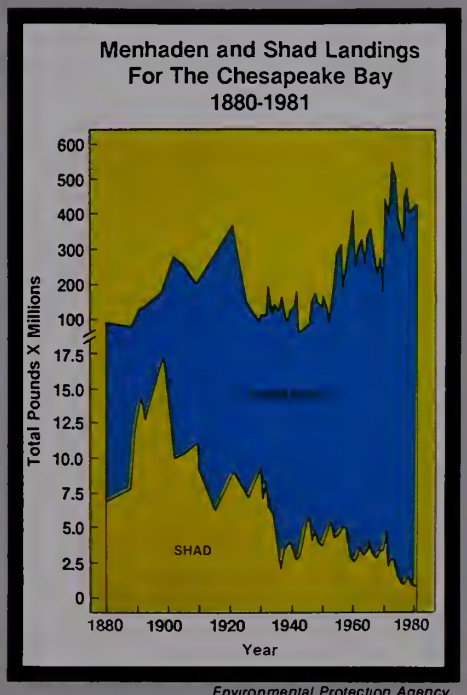
Chesapeake Bay oysters and blue crabs are widely known delicacies. The average annual oyster catch over the last 50 years has been approximately 27 million pounds of meat per year. Blue crab production totals about 55 million pounds annually, which makes the Chesapeake the largest producer in the world. More than half the total U.S. catch of both soft-shelled clams and blue crabs comes from the Chesapeake, along with more than a quarter of the nation's total yearly oyster catch. A thriving fin-fish industry, based primarily on menhaden and rockfish, rounds out the Chesapeake's major commercial seafood production. The value of the Bay's fishing catch exceeds $100 million annually.

Boasting two of this country's five major North Atlantic ports, the Chesapeake is also a key commercial waterway. The Hampton Roads complex, which includes Ports-

Harry Gillam

Virginia Institute of Marine Science

While sportfishing is popular on the Bay (left), commercial fishing is a profitable enterprise (left, below). In recent years, menhaden landings have increased and shad landings have decreased (below).



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mouth, Norfolk, Hampton and Newport News, dominates the mouth of the Bay. At the northern end, the Port of Baltimore handles nearly 24 percent of the export commerce leaving the U.S. North Atlantic ports, making it one of the top three commercial shipping centers on the East Coast. More than 90 million tons of cargo, with a value of nearly $24 billion, were shipped via the Chesapeake during 1979.

Nearly 50,000 commercial vessel trips are recorded annually from Chesapeake ports. Shipbuilding and other related industries also depend upon the Bay. Industries and power companies use large volumes of water from the Bay for industrial processes and cooling. The estuary also assimilates wastes generated by the 13 million people who live within the Chesapeake watershed.

The hospitable climate, lush vegetation and natural beauty of the Chesapeake have made it an increasingly popular recreation area. Boating, fishing, swimming, hunting and camping are the major attractions. Both power and sail boating have grown dramatically.

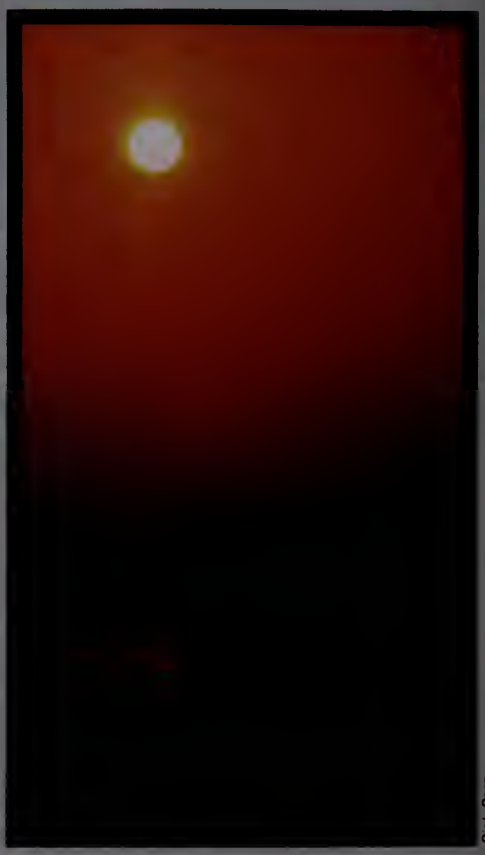
Sportfishing is another major recreation activity in the Chesapeake. A 1979 survey by the National Marine Fisheries Service estimated the annual sportfish catch at 28 million, which accentuates the value of the Bay as a breeding ground for desirable species of sportfish.

The Bay and tidal tributaries have absorbed considerable pressure yet have remained highly productive thus far. But we cannot count on this natural carrying capacity to endure any and all future pressures. In recent years, the Bay has been showing signs of wear and tear. Sewage and land run-off have markedly altered the nutrient balance of some of the Bay's tributaries and possibly of the upper Bay itself. Carbons, nitrogen and phosphorus content have increased and, more importantly, the ratios of one material to another have changed. The results of some of these changes are obvious; the pea green blankets of algae and the decline in submerged aquatic vegetation are two examples.

In fact, scientists say that large areas of the Bay are now actually dead during part of the year when the waters are contaminated by poisons and suffer from lack of oxygen caused by run-off, sewage and toxic chemicals flowing into the Bay and its tributaries. This is especially true in the

Bill Portlock

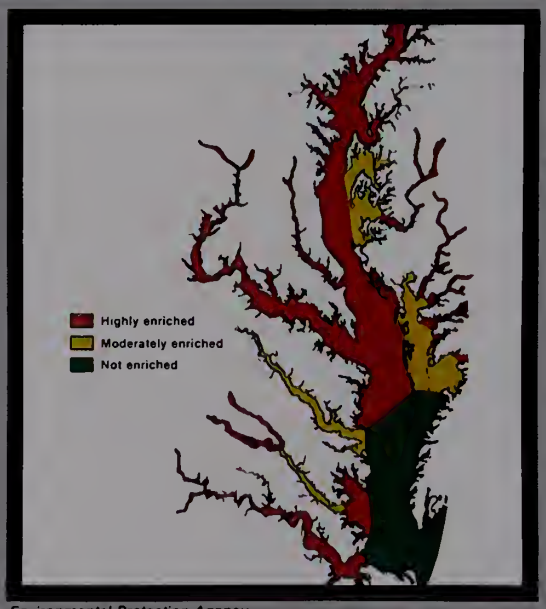
Wild rice (left) can be found in marshy areas surrounding the Chesapeake; however, some areas of the bay have become dangerously nutrient enriched (lower left). A colorful sunset (below) is just one of the bay's attractions.



Rick Perry

Status of Nutrients

The northern half of Chesapeake Bay and most of its tributaries are currently highly enriched with nutrients. All Eastern Shore embayments, the Rappahannock River and the middle portion of the York River are moderately enriched.



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northern reaches of the Bay where crabs, oysters and fish will be unable to survive if these conditions worsen.

Once-abundant sea grass that covered the Bay floor a few years ago has all but disappeared in much of the Bay. These life-supporting grasses provide the food and protection crabs and countless fish species need to survive.

Surveys of bay grasses have revealed a serious decline in populations throughout the Bay. Previously, fluctuations in abundance of certain species, such as eelgrass (reduced in the 1930's) and Eurasian milfoil (abundant growth, then reduction in the 1960's), have occurred, but the current situation may be a cause of concern because it is geographically so widespread and involves all species.

Our famous blue crabs are also threatened by the loss of sea grasses. During their critical molting period, crabs hide in the bay grass for protection. Without the shield these grasses provide, even the blue crab may have trouble surviving in the Bay.

Another important ecological function of bay grasses is their ability to slow water velocities, causing particulate matter to settle at the base of their stems. Because water thus tends to be clearer near grass beds, the plants are self-perpetuating due to the increased light. Finally, like marsh grasses, bay grasses can act as nutrient buffers, taking up nitrogen and phosphorus and releasing them later when the plants decay.

Declining catches of deep-living shad and striped bass and the disappearance of submerged rooted plants are the most visible evidence of change in the Chesapeake Bay and its tributary rivers. Conversely, menhaden catches are increasing, but menhaden do not spawn in the Bay; they come in to forage. They are filter feeders straining the abundant plankton from surface waters. Bluefish, which are also increasing, feed on the menhaden in the mid- to upper-water levels, indicating that conditions are not favorable to bottom living species. Other, more subtle signs of change have been documented by the just-completed Chesapeake Bay Program. Completion of this massive study is a milestone in the history of the Chesapeake Bay.

Years of concern about the condition of the Bay led to the initiation in 1976 of the Chesapeake Bay Program.

Congress authorized the expenditure of $25 million over five years by the Environmental Protection Agency. The EPA was directed to assess the health of the Bay and make recommendations for ways to improve it. This fall, the agency will submit to Congress its final reports on that effort.

The changes in the Bay that have been observed and documented by the EPA study are cause for concern. The major accomplishment of the Bay Program is the definition of the relative health of the Bay and its tributaries. The picture being presented by the Bay Program for three important water quality factors deserves our attention. These three are nutrients, dissolved oxygen and toxic chemicals.

Nutrients, those chemicals necessary for growth and development of plants and animals, are good and necessary in the estuarine environment. However, the Chesapeake seems to be experiencing a condition that could be described as "too much of a good thing." Major portions of the system are enriched with nitrogen and phosphorus beyond what scientists consider the optimum level.

The upper- and mid-Bay and many of the Bay's tributaries are either severely or moderately nutrient-enriched compared to what they have been historically. Nutrient levels have increased dramatically over the past 10 years in these waters, making them much more susceptible to algal blooms and resulting in low levels of oxygen and light. The nutrients causing enrichment problems are phosphorus and nitrogen, which come from sewage treatment plants, industrial discharges, urban stormwater and runoff from agricultural land.

The Chesapeake Bay Program has also found a clear correlation between the high levels of nutrients and lower levels of bay grasses and spawning freshwater fish. Apparently the level of nutrients in the Bay has exceeded the point where it can increase productivity. The excess nutrients are now beginning to inhibit the survival of sensitive species.

Turbidity also plays an important role in affecting the quality and quantity of light that reaches bottom plants. Excessive sediment from upstream and Bay-side sources contribute to this light problem as well as adding unwanted nutrients. Algal blooms at or near the surface fed by excess dissolved nutrients also reduce the light reaching bottom plants. The greatest concentrations occur in the late summer or fall, when the days are long and the water is warm. However, during some years the lower Bay shows a spring pulse (bloom), with large numbers of algae in evidence. These high concentrations of phytoplankton produce the characteristic green color of estuarine and nearshore waters.

Dissolved oxygen is a critical component of water and is, obviously, necessary for all the plants and animals inhabiting the Bay. Its availability is determined by temperature, salinity and biological processes. The Bay Program has documented an alarming decrease in dissolved oxygen (DO) in the Bay in summer months over the past 30 years. Low DO means that some areas of the Bay are uninhabitable for fish and shellfish in the summer. In some instances, zero dissolved oxygen has been measured. The absence of adequate dissolved oxygen seems to be related to nutrients, which trigger rapid algae growth. When these tiny plants decay, they consume oxygen, and the natural layering of the estuarine water prevents new oxygen from being mixed into the deep areas, thus suffocating bottom-living estuarine animals. This message about dissolved oxygen is one of the most alarming to be put forth by the Chesapeake Bay Program.

Of equal concern is the finding that the sediments in some portions of the Bay show high concentrations of heavy metals and toxic organic compounds. The highest metal and organic concentrations in sediments occur in the northern Bay, Baltimore Harbor and the Elizabeth River. At least half of the metal loads and all of the organic loads come from human sources, particularly industrial discharges, sewage treatment plants and urban runoff. In some areas, concentrations of toxic metals and organics in the sediments are high enough to cause mortality in test animals subjected to samples of these sediments. There is an inverse correlation between diversity of species living in the sediments and the level of toxic materials present.

The most dramatic finding of the Chesapeake Bay Program is that the circulation patterns of the Bay make it a sink for pollutants, including sediments, nutrients and toxic substances. We used to believe that materials carried into the Bay by streams and rivers were eventually flushed into the ocean. We now know that the suspended materials tend to settle and accumulate in the sediments. *What goes into the Bay stays there.* The entire drainage basin is part of the living ecosystem of the Chesapeake Bay. Any activity affecting the land and water in any part of the watershed may ultimately have an effect on the living resources of the Bay.

During the next few months, the Chesapeake Bay Program will complete its final management recommendations on alternative actions to reverse the trends of Chesapeake Bay resource and water quality decline in the Bay documented by the program. The states, working with the EPA, will develop plans of corrective strategies based on the EPA's recommendations.

Actions to halt the changes taking place in the Bay may include:

1. Further restrictions on municipal and industrial discharges to reduce nitrogen and phosphorus levels.
2. Soil conservation measures and tillage changes on lands contributing to sediment levels and nutrient load.
3. Further restrictions on discharge of toxic material and those which adversely affect dissolved oxygen.
4. Special zoning to restrict development or cultivation of shore lands in critical areas.

The states and the EPA are undertaking the necessary steps to insure a smooth transition of the Chesapeake Bay Program from a federal research program to a federal/state management program. This transitional period was made possible by the $900,000 congressional appropriation to the Chesapeake Bay Program for fiscal year 1983. In addition, the states themselves have made substantial contributions of funds and personnel resources to this effort. In partnership, the states and the EPA are developing plans and mechanisms for future joint monitoring of the Bay, operation and maintenance of the computer system and water quality models, and interstate cooperation on pollution control efforts.

Often called the "crown jewel" of all the world's estuaries, the Chesapeake Bay is truly a world-renowned treasure. Her future will depend on the determination and desires of Virginians and others who inhabit her shores. Our health, our economy, our recreation and our wonderful seafood resource may depend on the decisions we make now. □

by John Page Williams

RETURN of the Grey Trout

Rapidly increasing populations of these fish have made their Chesapeake Bay habitats popular and productive areas for the diligent angler.

Jack Randolph

Netting a grey trout (above); "Hey, I've got a fish!" (right).

Grey trout are pretty fish. They are delicious to eat if treated carefully and are strong, sporting game fish. There were very few of them around in the 1960's, and most of the ones that were here were small, under two pounds. A four-pound fish was a monster, big enough for a state citation but a rarity. As late as 1969, the winning fish in the Virginia Salt Water Fishing Tournament weighed under six pounds. But that situation changed. No one seems to understand the reason, but beginning about 1970 the trout population began to grow and sizes increased dramatically. The state tournament had its budget strained in 1971 by over 1,200 trout citations at four pounds and changed the weight the next year to seven pounds. Citation size now stands at 11 pounds, and several hundred fish are still submitted annually. Today a grey has to be 12 to 15 pounds before a seasoned trout angler calls it big.

No one seems to know why the trout returned to the Bay—and to the whole East Coast—in such numbers. It would be interesting to find out. And we must face the likely prospect that someday the population will decline again. But for now, there are a lot of them out there to enjoy and be thankful for.

One of the most pleasant ways to catch big trout is to go jigging for them in the summer. As the Bay water warms in the spring, trout move into the Chesapeake from their wintering grounds at sea. The Bay at this point is warming faster than the ocean, so baitfish such as silversides and menhaden are becoming active. Some trout follow them up the Bay as far as Annapolis, but the majority stay below the mouth of the Patuxent, just above the Point Lookout. Many congregate on Tangier Bar, the long triangular shallow area that extends south for 10 miles below Tangier Island.

These large fish, six to 12 pounds, are getting ready to spawn. With water temperatures now in the 60's and rising, their metabolism rates are increasing rapidly. Roe and milt are ripening in their bellies. Both processes require food; therefore, the fish feed heavily. They are in the Bay, in fact, for its warm temperatures and abundance of food.

By mid-June, the big fish begin to school up. Some will spawn on Tangier Bar, some farther down the Bay and some just outside the capes, on the continental shelf. Those that leave will be back later in the summer. In the meantime, smaller trout, one to three pounds, will move in for a while before spawning. The actual dates of the movements vary from year to year, but there are generally fewer trout on Tangier Bar late in the summer than in the earlier part. The numbers increase again in the fall.

The Bay has enough summertime trout for those anglers willing to work for them, and the one- to three-pound fish are especially delicious, but summer trout fishing is often hard work. The fish move around, and they feed only part of the time, often at night. When inactive, they are easy to find with a depth sounder but will not always take a bait or a lure.

Not so in June and early July. Find them and put lures in front of them, and they strike. The fish congregate at this time on the lumps at the upper end of Tangier Bar, just west of the entrance to Tangier Island's harbor. Here the main channel of the Bay is deep, from 70 to 140 feet. A deep curve makes this area a big food trap. The lumps are large, irregular formations on the bottom in 25 to 35 feet of water, just to the east of the channel edge. They may also follow that edge a couple of miles to the underwater point at Buoy 48 and move up onto the Bar there.

To fish this run, an angler needs several things. The first is a strong, able boat. The area in question is six to 10 miles

Jack Randolph

from Tangier and a similar distance from the Western Shore, out in open water. Seas can build quickly, especially during afternoon thunderstorms. Skiffs as small as 17 feet can make the trip if they are sturdy, well-maintained and dependable. But large craft, such as 23-foot center console models and 40-foot bay built boats are more comfortable. It is important that the skipper understand the strengths and limitations of his boat.

Locating trout requires a good navigation chart and a depth sounder. Members of the drum family, the fish occasionally croak like their cousins, the hardheads. The air bladder that produces the sounds also reflects sonar echoes, so the fish show up distinctly on flashing and recording sounders as large masses close to the bottom. Remember, though, that reading a sounder takes some practice. It is not magic. Time and concentration work together to help the angler get used to the machine. Learning to use it can be exciting; it can open one's eyes to an unseen world.

In May and early June, the trout are grouped loosely in small pods. In mid-June, they mass into large schools. These schools are certainly the easiest to fish, but the small pods can give anglers some exciting days, too. The idea is to put the boat directly over the fish and drop jigs down to them.

The first job, then, is to find some fish. Talking with the tackle shop operators and charter boat captains in the area will give the visitor a general idea of where fish can be found. Once on the water and in the general area, the skipper can look for a concentration of boats to get a better idea of fish location. From that point on, the sonar is the best guide.

The schools move around. They feed into the tide, so the most active fish will be on the uptide edge. Following the other boats is one way to stay with them. The watchword here is courtesy. A dozen boats on a small patch of fish can produce a real traffic jam. Generally, the boats will line up to drift over the school one by one. Then each skipper circles back around to the end of the line to make the drift again. Sometimes all the rods on the boat will get strikes, at other times only one or none will.

Under this kind of pressure, the school eventually moves. As the trout do so, they rise from the bottom, and the alert skipper can see this on the sonar. When they move, they will generally go across the Bar, either east or west, angling slightly with the tide. Running the boat at a moderate speed in a wide circle and watching the sonar is a good way to look for them (just remember there are other boats around to keep clear of). Sometimes the fish scatter; they may regroup later.

Fishing in a crowd can be an exciting and a satisfying exercise in cooperation, as large and small charter boats and private boats move together over a school. But it can also be frustrating. The enterprising skipper can sometimes do a little bird-dogging and find a pod that no one else is fishing. Experience helps. Time on the water gives one a sense of how the trout move around.

Tackle for these trout is simple. Spinning and plug gear with 10-15 pound test line is good. Lighter tackle is fine, too, in open water but not in the middle of the fleet. The rod should have a relatively stiff tip to maintain contact with the lure, but it should flex enough to prevent tearing the hook from the trout's soft mouth. Medium- to fast-action, six- to seven-foot rods rated for one- to three-ounce lures are good. A plug rod with a straight handle is more comfortable than an offset bass-fishing handle, since the angler can tuck it under his forearm for leverage while fighting a fish. Since there is no casting involved, a plug reel need not be an expensive ball-bearing model. But whatever the reel, it should have a clean, smooth, properly set drag. These fish are big and strong; a drag that catches and grabs will tear hooks loose and break lines.

The best lures for these trout are ones that work as they fall toward the bottom. A standard for years has been the Hopkins stainless jig, in either the No-Eql or Shorty models. The stainless head Hopkins bucktail is also good. A white or yellow conventional leadheaded bucktail with pork rind or a plastic trailer can be effective, too. For water of this depth, jigs should weigh one to one and two-thirds ounces to reach the bottom quickly. Hooks should be filed sharp.

With the boat over the fish, the angler drops the bait to the bottom. As it bounces on the sand or shell there, it should be raised a foot or so and allowed to drop again. Most strikes will come on the drop, with the fish coming toward the boat, so the angler should keep the line taut as much as possible, even when the jig is falling. Then conversation on the boat goes something like, "That's funny, my line has gone slack. . .Hey, I've got a fish." It is a remarkable experience to feel a line go slack, tighten it up and find a 10-pound trout bucking on the other end.

Somehow we are used to thinking that big, strong predatory fish smash baits with a vengeance. But most fish prefer to go after prey that is weak or wounded and thus easy to catch. Hence the effectiveness of the falling jig. There is a touch to fishing this that makes for a good angling challenge, like fishing a soft plastic worm for bass. It is not terribly difficult, but anyone who learns to do it has had to concentrate and exercise some skill. Hooking fish on falling lures can be as exciting as using surface plugs.

One trick that works sometimes when fish are schooled tightly is tying a 3/0 hook with a plastic twister or grub tail on a dropper loop above the jig. Sometimes the dropper draws more strikes than the jig. Sometimes the angler gets double hookups. A pair of eight-pounders will strain the rod—and the angler's wrist. Sometimes, too, those big fish head in opposite directions, and one pulls the hook out of the other's mouth.

But when the jig-and-dropper rig does bring two trout to boatside, it is nice to have a big net. Lifting one large trout, let alone two, without that net almost guarantees pulling a hook free. Besides, once the fishbox has enough fish in it, the net allows others that are caught to be released.

Tangier Bar in June means beautiful weather, pretty water, big trout and the challenge of hooking them on a falling jig. It's a good place to start the summer.

For those without suitable boats or for visiting anglers wanting to learn the waters before using their own boats, the Reedville/Smith Point area offers a number of excellent charter skippers, grouped together as the Smith Point Charterboat Association. Three of the best are Capt. Wallace Lewis of *Hiawatha* (804-453-5852), Capt. Ray Shepherd of *Southern Belle* (804-462-7149), and Capt. Don Markwith of *Midnight Sun* (804-224-7082). All three are good fishermen, and they all work to teach their parties to catch trout. If already booked for the early run, they can recommend other captains.

By the way, big trout are stronger-tasting and coarser in texture than smaller ones. The meat around the belly cavity is especially strong. But this strong flavor makes the meat especially good for smoking. Some people even prefer it to smoked bluefish. A good way to dress these big trout is to fillet them, skin them, and then split each fillet lengthwise along the lateral line. Save the top half for broiling or baking and smoke the lower half. □

The Subtle Thrills of Flatwater Canoeing

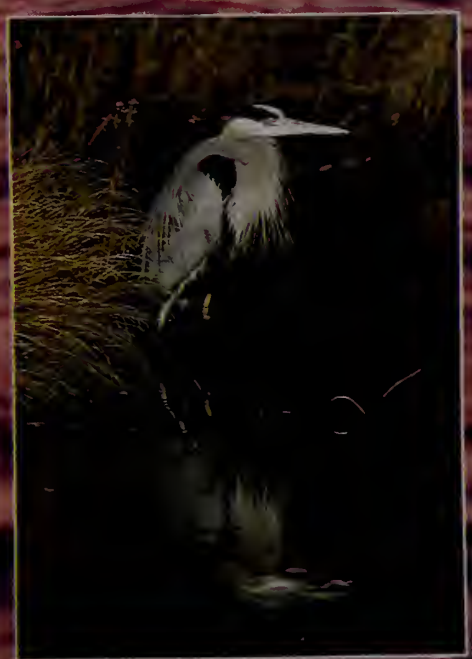
Don't enjoy the panic of whitewater? The Eastern Shore's creeks and bays offer a serenity comparable to floating in space.

by Curtis J. Badger

A friend from Lexington who canoes the white water rivers of Virginia's mountains says that shooting the rapids of the Maury River is probably the closest he will ever come to blasting off into space.

But if rivers such as the Maury offer the thrill of liftoff, I tell him, the Eastern Shore's creeks and bays might well compare with floating weightlessly through space. My friend from western Virginia, like too many canoeists, tends to snicker when I talk about the excitement of canoeing the flat water of the Eastern Shore. There are no rocks, no rapids, no boulders to challenge his skill with a paddle, so he doesn't see the attraction.

In addition to the enchanting pink and purple sunsets, the Eastern Shore's creeks and bays also provide a variety of wildlife, including pintails (right) and great blue herons (far right).



The Maury is a pretty river, I tell him. The only drawback is that it has all those rocks that get in the way of the canoe. Get those rocks out of there and you'd have a nice little river.

Perhaps my attitude is a product of growing up on the Eastern Shore, where my only exposure to white water came when I soaped up in the bathtub. Having had the misfortune to grow up around all this flat water, I never came to appreciate the fascination of hurling my body toward tons of jagged rock.

Panic and pain are not my ideas of fun.

My idea of canoeing is to pick a warm summer evening when the breeze is barely blowing. Load the canoe with a bucket of chicken, a cooler of your favorite beverage (naturally, it would be unwise to overindulge in one of the alcoholic variety) and your favorite companion (who should be a formidable paddler), and put in along one of the creeks that empty into the Chesapeake Bay. The water should be glassy as you paddle out to the creek as the sun sets over the Bay. Paddle just far enough to get to where the water is wide, eat your chicken, sip your beverage and watch the sun set.

This canoe trip involves minimal exertion and is as bereft of life-threatening situations as water can be. Your only worries will be dropping your short-joint overboard (carry spares), or being run down by some nut in a cabin cruiser (stay in the shallows).

While this trip is not intended to encourage the flow of adrenaline, it offers what might be called subtle thrills. Sunsets on the Chesapeake can be magnificent, and when the water is mirror-smooth the effect is doubled. . .thus the feeling of weightlessness, of floating effortlessly through space. You look up and the sky is washed in purple and pink afterglow, and you look down and the scene is repeated. The horizon virtually disappears. Only a rippled wake as you paddle reminds you that half your world is water.

You won't get this feeling in a motorboat; it's too big and noisy and puts too much fiberglass between you and the elements. A canoe puts you where you want to be; it's even shaped a little like a rocket. It's smooth and quiet and glides effortlessly through the water. It will never intrude upon your reverie.

Another favorite trip is to put in on a bayside creek, but instead of paddling toward the Bay, canoe toward the head of the creek. Along the wider stretches you can see elegant old Eastern Shore plantation homes where a century ago farmers loaded vegetable crops onto schooners that transported the produce to markets in Norfolk and Baltimore.

As the creek narrows and begins to spiral through the marsh and woodland, the country gets wilder. There will be no houses, no people, none of the sights and sounds of civilization. In these narrow, shallow creeks, it is not difficult to imagine you are seeing the same country the Accawmacke Indians saw four centuries ago. The water is too shallow for an outboard and the marsh is too mucky for hiking, so there is a sense of discovery. You'll find nary a drink can or candy wrapper to mar the experience. (Be sure you do your part to keep it that way.)

In the winter you will see black ducks, mallards and dapper little hooded mergansers. Great blue herons will startle you as they noisily take flight, sounding more than anything like a chainsaw with carburetor problems. In the summer the marsh is lush and green, and muskrats and raccoons and sometimes river otters can be seen swimming along the shoreline in the evening. Mullet, flashing like silver, jump three feet out of the water, for reasons only they know.

In winter the water at the creek heads is clear and you can see the bottom. Again, there is a feeling of flying: gliding softly over an underwater world where brown shafts of grass waver in the tide that bends them in a silent storm. I always have the feeling I'm going to find something interesting hidden on the bottom. An old Indian tomahawk, a piece of pottery, a musket left behind by a British soldier when he came up the creek in the War of 1812. Probably they are there, but they are hidden by silt accumulated over hundreds of years.

A handy tool for canoeing Eastern Shore creeks is the Department of Interior Geological Survey chart, otherwise known as the topo map. These charts are made from aerial photographs and very accurately show the location of creeks and other small bodies of water. Water depths are not as accurately shown, but since you're in a canoe, who cares? The charts also show paved roads and farm roads, making it easy to find put-in and take-out points. The charts are available from the Virginia Division of Mineral Resources, Charlottesville, Virginia 22903. Many outdoor recreation supply stores have them in stock, too.

Eastern Shore creeks are tidal, but the flow is not sufficient to make you labor unduly if you have to paddle up the creek on a rising tide and return when the tide ebbs.

Logical launching points are where roads intersect with the creek you want to explore, but sometimes intersections are just not available, or you might have to hack your way through 100 yards of jungle to get to the water. In such cases the fate of your canoe trip is in the hands of gracious local landowners. I've never been refused permission to launch my canoe in somebody's back yard, although I've had a few landowners question my sanity. In any case, be sure to ask first.

Almost any kind of canoe is suitable for exploring creeks, but if you have a choice, use a 16-foot or shorter boat. I use a 13-foot fiberglass canoe for two reasons. First, it is lightweight but stable and easily maneuverable in the narrow waterways. Second, it's the only one I own.

Bring your camera and binoculars: close encounters with a variety of wildlife are inevitable in these meandering channels. And if you go during warm weather, include insect repellent with your gear.

Canoeing the flat water of Eastern Shore creeks and bays offers its own rewards. It differs from white water canoeing in the way, perhaps, that cross country skiing differs from downhill skiing. It is not a sport of instantaneous thrills, of a sudden intense rush of excitement. It is more a sport of quiet discovery, something to be savored at leisure. □

Origins Unknown

Every raindrop carries with it some of the dregs of our civilization now known as nonpoint source pollution.

by Linda Smith

Most people picture pollution pouring into our waters through some visible or invisible pipe. There is another type, however, that begins with the rains that bathe our planet. As they run off they carry with them some of the chemicals and sediments that have been deposited on plant leaves, parking lots, farmer's fields and even our own chemically treated lawns. This mixture of sediment fertilizer, heavy metals and other chemicals moves into our rivers and eventually to the Chesapeake Bay. It is called nonpoint-source pollution, and as point-source pollution is being brought increasingly under control, contamination from non-point sources is now judged the more severe in many cases. Construction projects, farming, logging and dredging and many other activities can result in nonpoint or runoff pollution.

Causes

Sediment from soil erosion constitutes by far the greatest tonnage of runoff pollutants. Compounding this, many contaminants attached to the soil are carried off the land. In agricultural areas, soil particles leaving farms in runoff may take adhered pesticides, fertilizers and animal and plant waste. The first can be poisonous while the other two increase the nutrient (nitrogen/phosphorus) burden on streams and lakes. And animal waste can carry harmful disease-bearing micro-organisms that result, for example, in shellfish area closures.

In urban areas, careless storage or overuse of road de-icing chemicals, traffic-generated heavy metals, oil and grease, litter and debris, sediment from poorly managed construction sites and pollutants settled from the air can cause considerable damage to aquatic plants and animals. Faulty landfills and failing septic tanks which cause seepage through the soil to groundwater can add to the problem. Natural vegetation can help absorb the amount of storm runoff and slow its velocity. However, in highly developed or developing areas, the reduced amounts of vegetation replaced by the impermeable surfaces of pavements and roofs can greatly increase the frequency and severity of floods. In addition, high levels of nutrients and toxics can flow, relatively unabated, into receiving waters.

As a result of concerns over the health of the Bay, the Environmental Protection Agency undertook a $27 million study that is now almost completed. Nutrient enrichment and toxic substances in the Chesapeake were chosen as two of the three most critical areas for investigation under the EPA's Chesapeake Bay Program. Examples of toxics that enter the water from nonpoint sources include pesticides, metals such as arsenic, cadmium, chromium, copper and zinc, and chlorinated hydrocarbon compounds (PCB's). Once in the water, metals, for example, are available for uptake by phytoplankton (algae) and marine organisms. Once in the plankton, the metals can be passed through the food chain.

Effect on Bay Aquatic Life

Over 2,700 species of plants and animals inhabit the Chesapeake and its shoreline and depend on the Bay and each other for food, shelter and balance of the entire Chesapeake ecosystem.

Five major biological Bay communities that interact closely are the marsh dwellers, bay grass inhabitors, plankton, bottom residents and swimmers.

Marsh Dwellers

Marshes, spongy areas dampened by rain, groundwater seepage, adjacent streams and the Bay's tides, are transitional areas between the land and water that may slowly be converted to solid shoreline or may disappear due to erosion.

Because of their bountiful supply of nutrients, marshes are extremely productive—rather like fertile agricultural land. The abundance of food and shelter provided by the marsh grasses ensures a favorable habitat for a host of invertebrates, which feed on a wealth of decomposed plant and animal matter and, in turn, provide food for numerous species of higher animals.

The lighter color of the water nearest the shoreline is evidence of run-off, probably from this farm.

Bay Grass Communities

Some 10 species of Chesapeake Bay grasses are called submerged aquatic vegetation (SAV). Surveys of bay grasses have revealed a serious decline in populations throughout the Bay, and the study of SAV constitutes the third critical area of water quality related problems in the Bay studies by the EPA program. The current situation is cause for concern because it is so geographically widespread and involves all species.

Toxic materials such as herbicides or heavy metals in the surrounding waters can disrupt the physiology of the submerged grasses and cause them to die. Excessive nutrient enrichment may endanger the existence of submerged grasses by fouling plant growth and favoring the growth of nuisance algae, which, in turn, block out light available to the grasses and limit their growth.

Submerged grasses provide an important link in the food chain of the Bay's waters by offering protective cover and food for a diverse community of organisms.

Plankton

The predominantly microscopic community consisting of phytoplankton, zooplankton and bacteria exists largely at the mercy of the current and tide. Under certain conditions, plankton with red or brown pigment will produce a red-tinted bloom, sometimes referred to as a "red-tide." These blooms can have serious consequences. Once they begin to decay, decomposing organisms can completely deplete all dissolved oxygen reserves, suffocating other estuarine animals.

Bacteria, the undertakers or decomposers, serve an important function in the Bay—breaking down dead matter, particularly plants. Bacteria are either normal residents of the Bay or can be introduced through human sewage and runoff from the land. The variety feeding on human and other warm blooded animal waste is called coliform bacteria. Coliform in themselves are not harmful, but they are an indicator that pathogens (disease-producing bacteria) may be present. More coliforms are likely to be found near large population centers.

Benthic Life

Commonly called benthic life, the organisms that live on and in the bottom or sediments of the Bay form a complex assemblage of communities. An oyster bar that supports many small organisms is an example of a benthic community.

These organisms have an important effect on the physical and chemical condition of the sediments, especially the upper eight to 10 inches. Filter feeders, such as oysters and clams, pump large volumes of water through their bodies and extract food from it. Predators such as the blue crab scurry across the sediment surface. These activities all help to keep the sediments stirred up, increasing the rate of exchange of materials into the water and facilitating the passage of oxygen into the sediments. If toxic chemicals are present in the sediments, they can be taken up by benthic fauna, and in some cases harm them.

The Swimmers

The approximately 200 species of fish living in the Chesapeake may be divided into permanent residents and migratory fish. Smaller resident species include killifishes, anchovies, silversides, hogchokers and gobies. Both small and larger resident species are normally found in shallow water where submerged aquatic vegetation provides cover.

The migratory fish generally fall into two categories: those spawning in the Bay or its tributaries and those spawning on the ocean shelf. Yellow and white perch travel relatively short distances from their habitat in the brackish water of the Bay to freshwater areas in the upper Chesapeake to spawn. Striped bass also spawn in the low salinity areas of the Bay. Some remain in the Bay to feed, while others migrate to the ocean waters. Shad and herring are truly migratory, traveling from the ocean to fresh water to spawn and returning to the oceans to feed.

Other migratory fish spawn on the ocean shelf and use the Bay strictly for feeding. Croakers, drum, menhaden, weakfish and spot journey into the Bay while still in the larval stage and use the shallow waters of the Chesapeake as a nursery. The menhaden deserve a special note. They occupy the Bay in such abundance that they support a major commercial fishing enterprise. Adults of this category feed on the abundant supply of phytoplankton. Bluefish only enter the Bay as young adults or mature fish.

Swimming crustaceans include shrimp which spend most of their adult life near the bottom. Usually thought of as a "creeper," the blue crab has developed a swimming capacity with one pair of powerful legs that enable it to travel considrable distances. Finally, numerous members of the shark family enter the Bay, as do several marine mammals, including the porpoise.

Remedies

In order to ensure continuing existence of these and other species of plants and animals in Virginia, there are a number of projects underway, or recently completed, to help research and find management strategies for reversing the downward trend in water quality of Bay tributaries from nonpoint-source pollution. Emphasis in these projects has been placed on agricultural and, to a lesser extent, urban runoff and how Best Management Practices (BMP's) applied to the land in study drainage areas affect the quality and quantity of runoff.

Ware River Basin

As part of the Chesapeake Bay Program nonpoint-source research, four test sites within the coastal Ware River basin, which drains into Mobjack Bay, were studied between October 1979 and July 1981. Runoff quality and quantity were monitored on agricultural, residential and forested lands.

Runoff from the agricultural sites had the highest concentration of pollutants and the forested sites the lowest. Because sites with similar land use showed different pollutant loading rates, the study recommended that factors such as soil type, slope and ground cover also need to be considered in making realistic pollutant load projections.

At the residential site, leaching of nearby septic drainfields into the groundwater or lawn and garden fertilizer applications may have increased the nutrient level of the baseflow. Research suggested that future watershed studies in coastal areas monitor groundwater processes, since significant pollutant percentages can be passed to receiving waters via a subsurface route.

Occoquan Watershed

The second nonpoint-source study took place between May 1979 and May 1981 at nine water quality monitoring stations in the Occoquan watershed in Northern Virginia. The effects of contrasting BMP approaches (no-till versus minimum-till cropping, heavy versus light grazing, detention ponds) under various land uses (corn cropland, pastureland, forest and suburban development) on runoff and nonpoint pollution were emphasized.

Results of the study showed that the heavily grazed pasture generally produced the highest pollutant concentration, while forest and lightly grazed pasture sites produced the least pollutant export.

Urban Runoff

Also in the Occoquan watershed, which is part of the Potomac River basin flowing into the Chesapeake, data collected from an EPA National Urban Runoff Program (NURP) will measure the efficiency and cost-effectiveness of specific BMP's designed to control runoff pollution. In this predominantly urban watershed, the effects of BMP's such as wet ponds, dry ponds, infiltration trenches, infiltration pits and roadside grassed swales are being tested.

The basic concept behind these BMP's is to slow down the amount and velocity of runoff by allowing the stormwater to be absorbed into the soil and by allowing sediment particles, including any adhering contaminants, to settle out before the water flows into storm drains or streams.

Cooks Creek

The Cooks Creek watershed, located south of Harrisonburg in Rockingham County, is also in the Potomac River basin. This mainly agricultural area also has highly erosive limestone soils and runoff from fertilizer and pesticide applications. Because all of these factors can contribute to water quality problems, the Agricultural Stabilization and Conservation Service (ASCS) of the U.S. Department of Agriculture has provided cost-sharing funds to farmers to install appropriate BMP's. These include animal waste-holding pits to salvage waste that might enter streams, sod waterways to absorb nutrients being transported by runoff, cropland protective cover and permanent vegetative cover to reduce erosion from fields.

Lake Chesdin

Within the James River basin, the EPA has funded a study under the Clean Lakes Program of Lake Chesdin, a manmade reservoir formed by damming the Appomattox River. The lake serves as a water supply and recreational area for Petersburg area residents and has experienced water quality degradation in recent years from high sedimentation rates, nuisance blooms of blue-green algae and high levels of iron and manganese. The latter two problems have caused taste and odor problems, and the former has caused loss of lake volume.

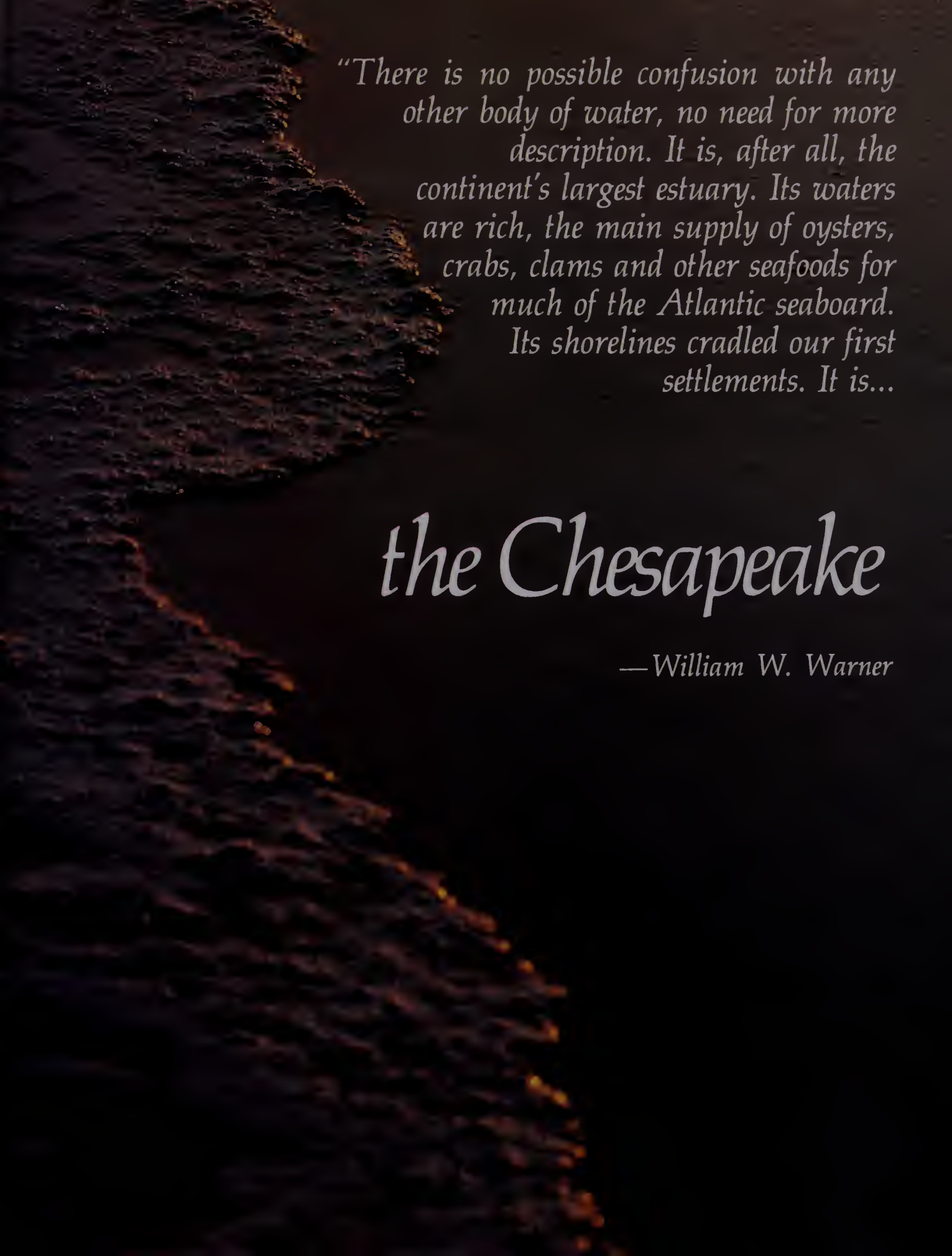
Nansemond-Chuckatuck

Finally, a 10-year federal Rural Clean Water Project (RCWP) to combat agriculturally-related nonpoint-source pollution is underway in the Nansemond River and Chuckatuck Creek watershed. Livestock operations in the project area have resulted in high nutrient and bacteria levels in these now condemned shellfish growing areas of Isle of Wight County and the City of Suffolk.

The U.S. Soil Conservation Service is providing technical assistance to area farmers, while the ASCS is providing cost-sharing money to farmers for the installation of BMP's which should help reduce nutrient, sediment and bacteria loadings into area streams. Of 21 RCWP's funded across the country, the Nansemond-Chuckatuck program ranks third in participation and results.

As information from the aforementioned studies is analyzed and applied to pollutant reduction strategies in the Chesapeake Bay drainage area, the chances for returning to and maintaining a healthy environment for the Bay's living organisms will be improved. This effort will require total commitment from those that contribute to the problems as well as effective management of water quality and quantity by responsible agencies.

Those that enjoy the Bay, such as hunters, fishermen, boaters and others, must continue to push for the necessary remedial actions to keep the Bay in a condition that future generations of Virginians can use and enjoy. □

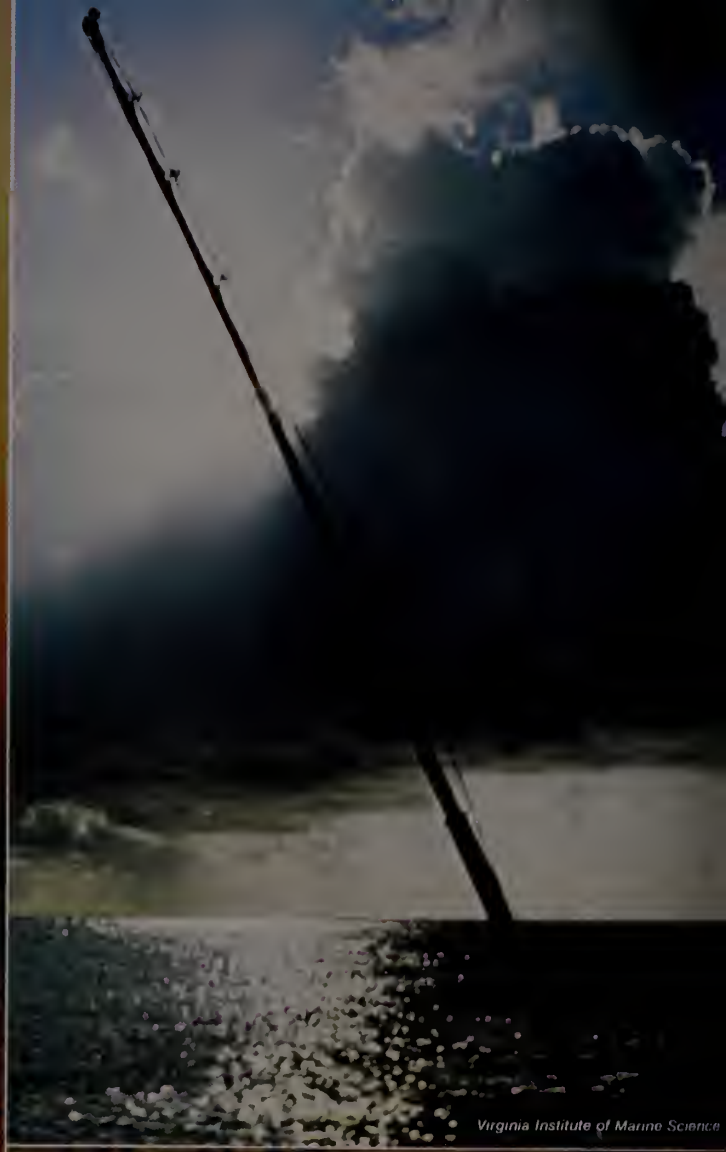


"There is no possible confusion with any other body of water, no need for more description. It is, after all, the continent's largest estuary. Its waters are rich, the main supply of oysters, crabs, clams and other seafoods for much of the Atlantic seaboard. Its shorelines cradled our first settlements. It is...

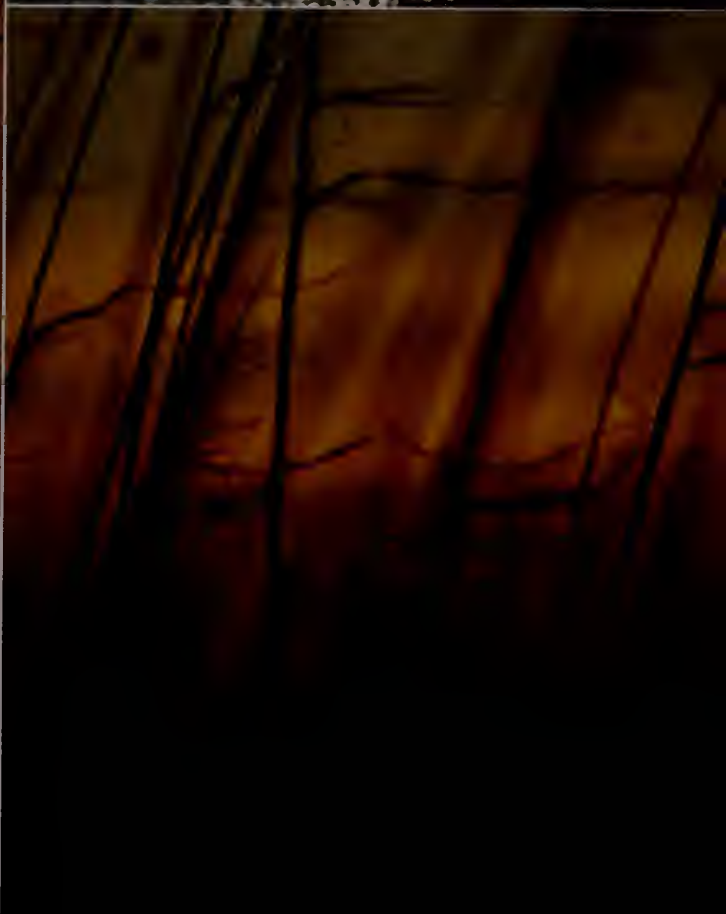
the Chesapeake

—William W. Warner

Virginia Institute of Marine Science



Virginia Institute of Marine Science



"North to south, from the choppy wavelets of the Susquehanna Flats to the rolling surges of the Virginia capes, the Bay measures almost exactly two hundred miles. Alone among its vital statistics, its breadth is not impressive . . . .In all else the Bay is champion . . . .The Chesapeake does not impress those who know it best as the grandest or most of anything. For all its size and gross statistics, it is an intimate place where land and water intertwine in infinite varieties of mood and pattern. . . .Delightsome, fruitful, pleasant. So it is, most would say, to this day."

From *Beautiful Swimmers* by William Warner
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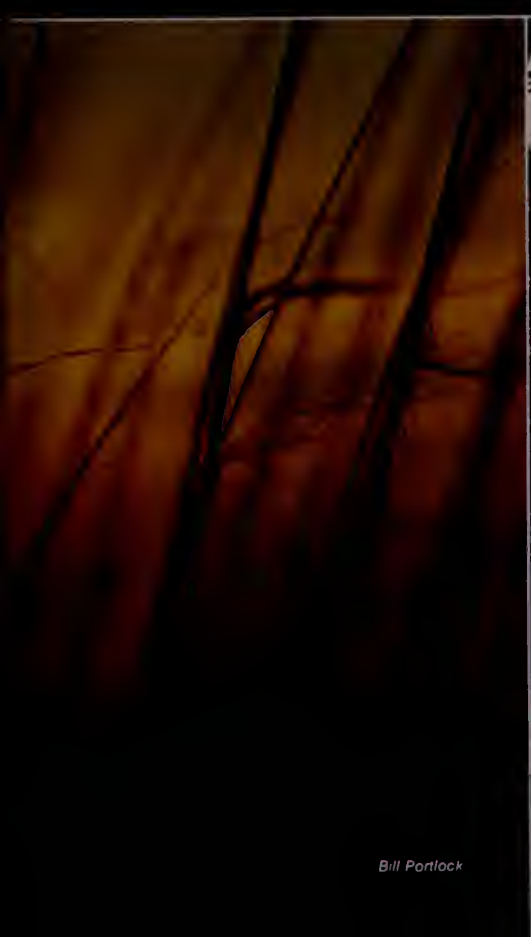
Bill Portlock



Bill Portlock

Bill Portlock

Curtis Badger

Special Section

Governor's Conference On The Bay Scheduled For December

Responding to public interest in the Chesapeake Bay generated by the EPA's Chesapeake Bay Program, Governors Charles Robb of Virginia, Harry Hughes of Maryland and Dick Thornburgh of Pennsylvania, with the Chesapeake Bay Commission, will convene for a three-day conference concerning the Bay at George Mason University in Fairfax, Virginia, on December 7, 8 and 9, 1983. It will be open to the public.

This conference is the third of its kind concerning the Chesapeake. It will be preceded by a series of workshops using all available information concerning the Chesapeake Bay to clarify and define problems, recommend needed change, and draft a plan of action to be supported by the public and implemented by government.

The conference will provide a forum for presentation of facts and proposed solutions, encourage public participation in the regulatory process and obtain commitments to broad courses of action from policy-makers.

Shaped by the EPA Chesapeake Bay Program, the conference is being designed by a steering committee composed of representatives of state agencies in Maryland, Virginia and Pennsylvania; the District of Columbia; the Chesapeake Bay Commission, EPA's Chesapeake Bay Program, the Interstate Commission of the Potomac River Basin, the Susquehanna River Basin Commission, Chesapeake Research Consortium, Chesapeake Bay Foundation and the Citizens Program for the Chesapeake Bay, Inc.

The conference is being sponsored by Maryland, Virginia, the Chesapeake Bay Commission, the Environmental Protection Agency and the District of Columbia and will be managed by the Citizens Program for the Chesapeake Bay, Inc.

For further information contact:
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About the Authors

We are pleased to have **Governor Charles S. Robb** as our contributor to this month's special editorial page. **Michael J. Oesterling** is a fisheries specialist with the Sea Grant Program of the Virginia Institute of Marine Science in Gloucester Point. **Dr. George Flick** is also associated with the Sea Grant Program, and is on the faculty of the department of food science and technology at Virginia Tech in Blacksburg. **Fran Flanigan** is director of the Citizens Program for the Chesapeake Bay in Baltimore. **Bill Portlock** and **John Page Williams** are with the Chesapeake Bay Program; Portlock works out of Richmond, Williams out of Annapolis. **Curtis Badger,** another regular contributor to the magazine, is a freelance writer living on the Eastern Shore. **Linda Smith** is an information officer with the State Water Control Board. Richmonder **Bruce Potter** continues as editorial assistant on this issue. The Washington & Lee University junior interned with the editorial staff this spring. Cover artist **John Barber** is well-known for his work documenting each of the remaining Chesapeake Bay skipjacks.

The Chesapeake Bay Skipjack "Sigsbee"

What Do You Know About Wetlands?

by Leon Kolankiewicz

Citizens Program for Chasapeake Bay

How many of us can honestly admit that we haven't, at some time or another, gazed eagerly upon some swamp, marsh or other "wetland," and thought: "Just think how *useful* this place could be if only it were filled in!"

I must confess guilt and, so I suspect, must many readers (especially those on whose property such areas are found). It is this very notion of wetlands as wastelands just crying for improvement that conservationists have been striving mightily over the past few decades to expel from the American consciousness. Spurring on their efforts have been the grim tidings of reports declaring variously that one-third, one-half or two-thirds of America's wetlands have been destroyed or irreparably reduced in quality, and that the onslaught has only just begun.

To undercut the wave of assaults on this unique natural resource, ecologists have studied them thoroughly in the hope of convincing the average American that wetlands do have value—not just the value of a potentially developable site, but also the great value in their natural, undeveloped state. The values commonly ascribed to wetlands are:

1. Buffer against erosion
2. Water quality improvement
3. Groundwater recharge
4. Flood control
5. Contribution to fisheries
6. Utilization by wildlife

Unfortunately, the wetland advocate cannot, in all honesty, just "exclaim to the world" that wetlands, *all* wetlands, reduce erosion, purify water, recharge groundwater, dampen floods and produce fish and wildlife.

First, not every wetland can claim each of the above values, for there are many types of wetlands, and some are much more valuable than others. Second, and perhaps more significantly, there is much disagreement among wetland biologists and other scientists as to the actual extent of the values alleged above. For example, it is extremely difficult to determine just how valuable Virginia's wetlands are to her sport and commercial fisheries.

The debates and the destruction continue, but in the meantime, conservationists have managed to press through state legislatures considerable legislation aimed at protecting wetlands. In 1972, Virginia enacted the Virginia Wetlands Act, offering local governments in the Tidewater areas of the state an opportunity to preserve their wetlands. To date, it is considered partially successful.

The following quiz will test your knowledge of Virginia's wetlands. Select the answer you believe to be most nearly correct.

Questions

1. Coastal wetlands occupy what portion of Virginia's total area?
   (a) 15 percent
   (b) 10 percent
   (c) 5 percent
   (d) 1 percent
2. What share of Virginia's tidal wetlands has been lost to direct human encroachment in recent years?
   (a) 33 percent
   (b) 25 percent
   (c) 10 percent
   (d) 1 percent
3. What is the difference between a marsh and a swamp?
   (a) Marshes are coastal wetlands; swamps are wetlands away from the coast.
   (b) Marshes are characterized predominantly by non-woody vegetation; swamps by woody vegetation.
   (c) Swamps are characterized predominantly by non-woody vegetation; marshes by woody vegetation.
   (d) There is no distinction agreed upon even by knowledgeable people; the meanings vary from place to place and person to person.

4. What biologists refer to as primary productivity is the amount of plant matter produced by photosynthesis. On the average, how productive is wetland vegetation relative to other vegetative associations?
   (a) About as productive as semi-arid grasslands
   (b) About as productive as temperate forests
   (c) About as productive as tropical rain forests
   (d) About as productive as domestic croplands
   (e) More productive than domestic croplands
5. Why is *detritus* an important word to wetland ecologists?
   (a) Ospreys and bald eagles rely on it heavily for nesting material.
   (b) Marsh grasses depend on it for nutrients essential to growth.
   (c) It is believed to form the base of marine food chains on which commercial and sport fish species depend.
   (d) It is to a large extent responsible for the great sponge-like capacity of many wetlands.
   (e) All of the above.
6. How permanent a feature of the landscape are the wetlands on any one site?
   (a) Extremely transient—substantial changes occur from season to season.
   (b) Moderately transient—great changes occur over periods of several years.
   (c) Moderately permanent—changes generally occur over periods measuring in the decades.
   (d) Very permanent—thousands or millions of years are required to create or destroy wetlands in significant amounts on any given site.
7. Marshes exhibit *zonation*; that is, different zones exist, each of which is characterized by a predictable combination of marsh features (like plant species composition, productivity, animal life and so on). The zone that is found on any one site depends directly on variable environmental factors. What are the two most important of these?
   (a) Degree of salinity and extent of submergence/saturation
   (b) Strength of wave action and type of sediment
   (c) Water temperature and slope of bank
   (d) Degree of salinity and seasonal fluctuation in air temperature
   (e) None of the above
8. From the point of view of the extent of protection they receive under Virginia's Wetlands Act, what do you think the great Dismal Swamp and unvegetated tidal flats have in common?
   (a) Neither can be filled and built upon.
   (b) Except under demonstrated extreme conditions, the only purpose for which they may be altered is to be put to agricultural use.
   (c) They are protected by more stringent regulations than other wetlands in the state.
   (d) Unlike other wetlands designated by the Act, dredging and spoil disposal, because of their especially disastrous consequences in the Dismal Swamp and unvegetated tidal flats, are entirely prohibited.
   (e) None of the above.
9. In general, are biting bugs more of a problem in fresh or salt-water marsh country?
10. Virginia is often divided into several physiogeographic provinces by geographers and geologists—such as the Coastal Plain, Piedmont, Appalachian Ridge and Valley, Blue Ridge, and Allegheny-Cumberland Plateau. What portion of the state's wetlands do you think lie in the Coastal Plain province?
    (a) 33 percent
    (b) 50 percent
    (c) 66 percent
    (d) 90 percent
    (e) 97 percent

Answers

1. *(d)* Although two major surveys, one in the early fifties and the other in the late sixties produced two different figures (mostly because of different concepts of "wetland"), both are in the vicinity of one percent, or about 400,000 acres.
2. *(d)* In 1969, Fairfax Settle of the Game Commission estimated that 1.2 percent (4,026 acres) of Virginia's tidal wetlands had been destroyed by man in the 15 year period from 1955 to 1969. Most losses occurred on the Eastern Shore. New Jersey and North Carolina experienced considerably greater losses during similar periods. While the rate of loss accelerated during Settle's study from about 20 acres/year to about 90 acres /year, the 1972 enactment of the Wetlands Act is supposed to have slowed the rate of loss to about 25 acres/year.
3. *(b)* This seems to be a universally held view in literature on wetlands.
4. *(e)* There is very great variation in the productivity of wetlands but on the balance they are probably richer than croplands. Five to six tons of plant matter per acre per year is a reasonable average for wetlands overall, though on a very good site a high of 25 has been recorded. Virginia's average is probably somewhere just below the overall average. Croplands yield anywhere from about one to five tons/acre/year.
5. *(c)* *Detritus* is dead organic matter carried by tides out to sea and fed upon by small marine organisms that form a base of coastal food pyramids. It is still debatable just how important *marsh* detritus (from fallen plant stalks) is in this regard relative to other sources of detritus, such as upland vegetation transported downstream and into estuaries.
6. *(c)* Although wetlands may appear relatively unchanging to the undiscerning human eye (except after cataclysmic storms, perhaps), by geologic time standards they are very dynamic, even ephemeral. Wetlands are in a near-continuous process of change—being added to and subtracted from, or disappearing altogether as succession takes its course.
7. *(a)* Other factors may indeed be *correlated* with zonation without *causing* it. Marsh plants vary in their capacity to withstand varying salt concentrations and flooding regimes, with zones of different species ensuing.
8. *(e)* What the Great Dismal Swamp and unvegetated tidal flats have in common is that they receive *protection* under the 1972 Wetlands Act, for the simple reason that they do not qualify as "wetlands" under the definition used in the Act! Wetlands, according to the Act, are vegetated (disqualifying unvegetated tidal flats) and fall in or near the tidal zone (disqualifying the Dismal Swamp). The omission of unvegetated tidal flats is considered unfortunate by biologists, because of their value to marine life, but to this writer's knowledge, there has been no great outcry about the omission of inland wetlands. The purpose here of emphasis on this point is not necessarily to criticize, but to stress that "there are wetlands, and there are wetlands."
9. In general, the Culicidae (mosquitoes) and Tabanidae (horseflies, deerflies, greenheads, etc.) families are worse in more saline marshes. In the 1930's extensive ditching was carried out in marshes all along the Eastern Seaboard for mosquito control.
10. *(d)* This figure is cited in the U.S. Fish and Wildlife Service inventory of Virginia's wetlands and seems to be about what one would expect. In the uplands there are no coasts and fewer broad floodplains and flat low-lying areas, on which wetlands are found. □

A visit to the tidal fresh upper sections of Virginia's Western Shore rivers can lend a new meaning to....

Going to the RIVER

by John Page Williams

photos by Bill Portlock

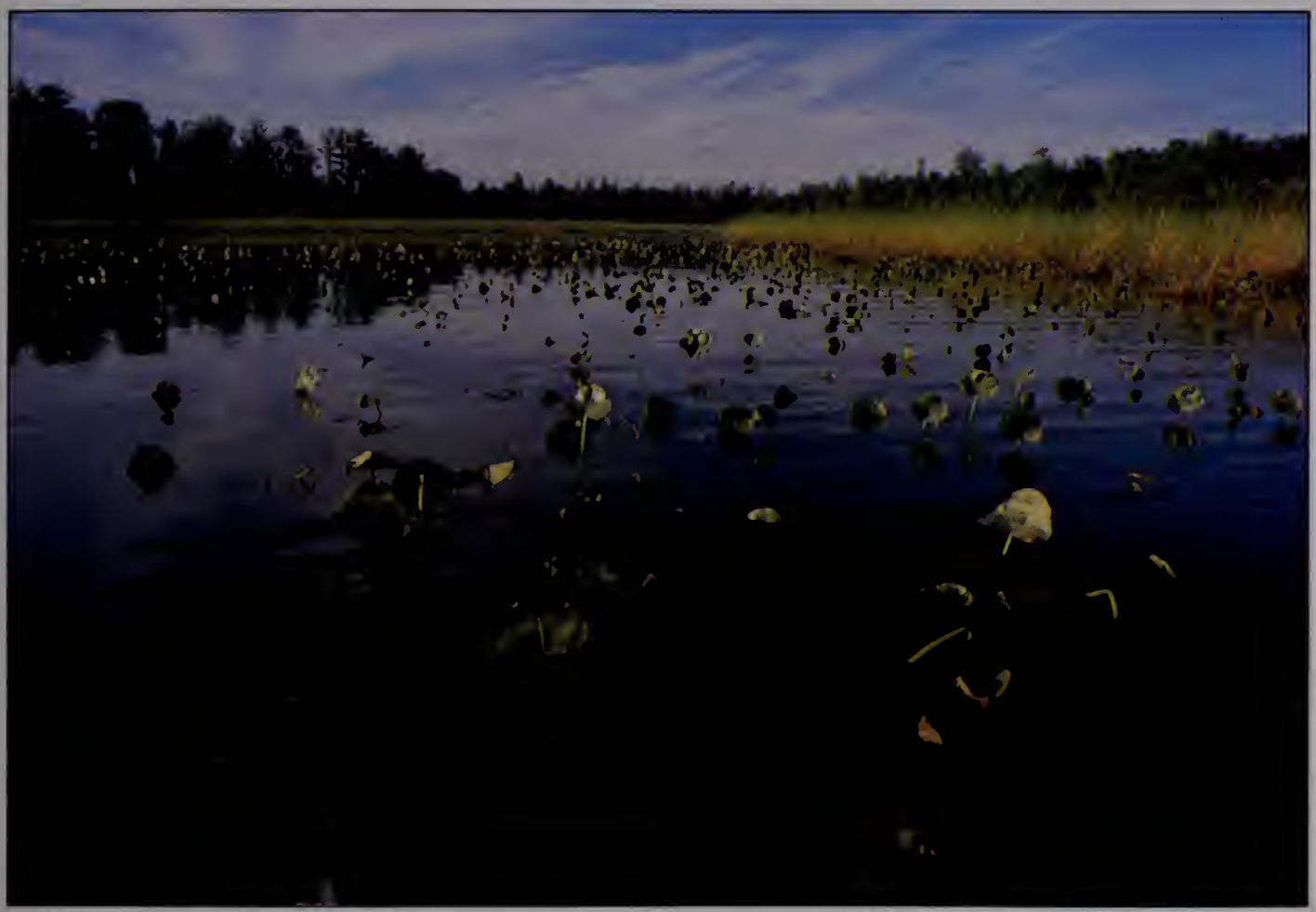
Virginians love to spend vacations on the water. Coles Point and Sandy Point on the Potomac, Bowlers Wharf and Morattico on the Rappahannock, Deltaville and Gwynn's Island, Bavon, or Gloucester Point, the list is long. But "the river" tends to be to the lower parts of the rivers, or to the Bay shore itself, all places with beaches and vistas of broad salt water. There are other river places, though, that are different but at least as attractive.

In an estuary like the Chesapeake with heavy freshwater input from many rivers, the influence of the tides extends farther upstream than the salt that comes in from the sea. This upper section on each river is called tidal fresh. Just below it is a section of very low salinity, called oligohaline or simply brackish. Thus a river can have a large portion of tidal water that is fresh or nearly so. In fact, each of the big rivers on Virginia's Western Shore has a section like this that is rich in plants, animals and natural beauty. Appreciating them does not take a lot of schooling, but it does take curiosity, patient observation and the desire to do a little reading to help fit the pieces of the puzzle into patterns.

Most people who come to love the tidal fresh rivers and creeks start off as bird watchers, hunters, fishermen, trappers or a combination of all four. Having a special interest in great blue herons, wood ducks, largemouth bass or muskrats draws one to the water. But special interest in one member of the river community often grows to curiosity about the community as a whole. This inevitably leads one to the plant community, and even beyond, to the geological processes that give rise to the plant community. So the bass fisherman finds himself still a bass fisherman, but one with a broad outlook and roving eyes and ears, one whose fishing experiences are enriched by the added dimensions of the community of which the bass is a part. It is this sort of person who comes to love the Chickahominy, the Pamunkey, the Mattaponi, Dragon Run or all the deep, strong creeks of the Rappahannock and the Potomac.

Estuaries are traps. Water flows into them from both ends, in from the ocean on the tides and down from the rivers. These flows set up complex patterns of currents and salinities, but the principle remains: estuaries trap and concentrate sediments, plant nutrients and food.

The upper rivers tend to have narrow, deep channels with strong currents, both tidal and downstream. As the current flows around a curve in either direction, the water on the outside edge accelerates and erodes the outer bank, while the water on the inside slows down. Any sediment or food material it is carrying settles out. These curves are called meanders. All of the upper tidal portions of Virginia's



Lily pads and long, marshy grasses are typical of the upriver areas in the Chesapeake basin (top); the variety of wildlife in these areas includes dragonflies (left) and butterflies (above).

rivers have them. Depending on the size of the river and the nature of the soil on the banks, the result may be steep clay banks (as on the Mattaponi) or high bluffs (like the Cliffs of Fone above Tappahannock) on the outsides of the curves and broad, fertile mud banks on the insides.

But the mud banks never get to stay just mud banks. They come from fertile upland soil, and they are still just as fertile now, though much wetter. These banks grow into extensive marshes (like Sweet Hall and Lily Point on the Pamunkey) and from them comes much of the food that fuels the river community.

Special interest in one member of the river community often grows to curiosity about the community as a whole. (Left) Green tree frog and pickerelweed, two members.

The marshes grow several tons of plant material per acre per year. Only a tiny percentage of it is grazed while still alive. After dying in the fall, it decomposes. About half of this tonnage of stalks and leaves rots in place and becomes part of the marsh soil, this renewable compost ensures continuing fertility. But the other half is flushed out into the water by tides and rain. These bits and scraps of decaying plants, with associated decay bacteria and fungi, are a sort of vegetable soup for the animals in the rivers and creeks. Biologists refer to it as marsh detritus. It feeds a variety of worms, freshwater clams and mussels, grass shrimp and tiny crustaceans, including amphipods, copepods and water fleas. Copepods and water fleas are free-swimming and move with the currents and wind; they make up the major part of the zooplankton population.

The vegetable soup, and thus the zooplankton, are especially thick in the spring, as rains flush the marshes. So there is quite a lot of food in the upper river, where the currents are strongest. This combination of food and current is particularly important. A number of Virginia's most important fish—herring, shad and rockfish—spend most of their lives at sea or in the Bay but return to the rivers of their birth to spawn. Their eggs have neutral specific gravity, or nearly so. They need relatively high current velocities to keep from settling to the bottom and dying. The upper tidal rivers meet the needs of these spring-spawning fish, as they have heavy current flows then, and abundant zooplankton to feed the developing larval and juvenile fish. April and May are exciting times on the rivers.

As summer comes, other fish arrive to mix with the resident silversides, shiners, anchovies, darters and killifish and the young shad, herring and rockfish. Young-of-the-year spot and menhaden, both born at the mouth of the Bay, move up the rivers to feed on the abundant food and escape large predators such as bluefish and trout. Some, of course, are eaten by herons, bass and river otters, but the rest are safer than their siblings that stay in the Bay. The menhaden are especially numerous. Sometimes a whole bend or cove in a tidal creek will be dimpled by a shoal of them, filtering out zooplankton and detritus.

The net result of this marsh-based community is food by the ton for the river's bass, pickerel, crappie, sunfish, white perch, rockfish, yellow perch, channel catfish, eels and gars. These have great recreational value. And the value of the marsh nurseries for menhaden, spot, herring, rockfish and shad should not be underestimated. They are vital links in the life cycles of these important species.

The value of the marshes to the community in the river itself is reason enough to be interested in them. But there is more. Several of the plants, like giant cordgrass, cattails, sweetflag, olney threesquare, American threesquare and giant bulrush have tender rootstocks and stalkhearts that sustain large muskrat populations. Beavers flourish in wooded areas at the heads of the creeks. Each river has several families of otters living on its fish. And each is home to plenty of raccoons.

Value to waterfowl and other birds is even greater. Most of the low salinity marsh plants are heavy seed producers, and those seeds are high in protein and either starches or oils, both efficient energy storers. Smartweeds, tearthumb, wild rice, rice cutgrass, beggarticks, millet, waterhemp, pickerelweed and arrow arum produce tons of seeds each fall that sustain ducks, blackbirds and sora rails through the colder months. The combination of marsh plants, trees and fields on the banks and productive water makes these rivers extraordinary habitats for a broad variety of birds.

There are plenty of reasons for ornithologists, fishermen, hunters and trappers to be interested in the functional values of these upriver marshes. But sooner or later these careful observers notice something else: the marshes are beautiful and interesting in their own right. There is a fascination in the change of seasons, as winter's brown stubble and bare mudbanks give way to thousands of tiny green shoots.

The shoots grow slowly through May, but as summer comes in mid-June, their growth rates explode. Within a month, by mid-July, the marshes are thick, lush water gardens, banquets of green, with thick stands of arrow arum and pickerelweed (June-September), white or pink marsh hibiscus (August-September), pink and gold mallow (August-September), brilliant red cardinal flower (August), purple ironweed (August) and loosestrife (August). All of these are set against the rich greens, laced by the brilliant orange parasitic vine, dodder.

As September turns cool, the blossoms fade, the rice stalks wither and fall and the green turns slowly to gold and then to brown. Beggarticks, called butterweed on Maryland's Patuxent River, form a golden carpet on the marsh till the first frost. From then on, the marsh reverts gradually to brown stubble and bare mudbanks. But late fall is worth seeing; all the tonnage of seeds has brought in ducks and geese for the winter and the pickerel and bass are feeding actively. Besides, the brown stubble is worth looking at and thinking about. Winter weather will break it up further. It will eventually be food for next year's young herring, perch and rockfish.

On these rivers, there is something worth seeing almost every week, straight through the year. Those who appreciate them smile at the stream of cars that cross them in summer, while "going to the river." The fewer of those cars that stop, the less the river people have to share their treasures. □

A Collector's Item

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1983-1984

Sportsmen are great collectors, whether it's decoys, firearms, old shell boxes, vintage fishing tackle, wildlife prints, trophies. . .or the *Virginia Wildlife Sportsman's Calendar*.

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